**3GPP TSG-RAN WG4 Meeting # 109 R4-2318221**

**Chicago, USA, November 13 – November 17, 2023**

**Agenda item:** 8.33.7

**Source:** Moderator (Ericsson)

**Title:** Topic summary for [109][329] NR\_mobile\_IAB\_demod

**Document for:** Information

# Introduction

*In WID RP-232643, following objectives are stated for mobile IAB.*

*The detailed objectives of the WI are listed as follows:*

* *Define Procedures for migration/topology adaptation to enable IAB-node mobility, including inter-donor migration of the entire mobile IAB-node (full migration) [RAN3, RAN2]*
	+ *The mobile IAB-node can connect to a stationary (intermediate) IAB-node. Optimizations specific to the scenarios, where the mobile IAB-node connects to a stationary (intermediate) IAB-node, or where it directly connects to an IAB-donor-DU are de-prioritized.*
	+ *The mobility of dual-connected IAB-nodes is down-prioritized.*
* *Enhancements for mobility of an IAB-node together with its served UEs, including aspects related to group mobility. No optimizations for the targeting of surrounding UEs. [RAN3, RAN2]*

*Note: Solutions should avoid touching upon topics where Rel-17 discussions already occurred and where the topic was excluded from Rel-17, except for enhancements that are specific to IAB-node mobility.*

* *Mitigation of interference due to IAB-node mobility, including the avoidance of potential reference and control signal collisions (e.g. PCI, RACH). [RAN3, RAN2]*

*The following principles should be respected:*

* *Mobile IAB-nodes should be able to serve legacy UEs.*
* *Solutions providing optimization for Mobile IAB may entail Rel-18 UE enhancements, provided that such enhancements are backwards compatible*

*RAN4 is expected to study impact on RF and RRM requirements:*

* *Conduct co-existence study to assess the impact of moving cells. Based on the study outcome, specify RF and RRM requirements and mechanisms for the mobile IAB-node to enable co-existence, if needed.*
* *Specify RRM requirements for the mobile IAB-node to enable IAB-node mobility, if needed.*

*Following items are stated for performance part.*

* *Specify RF conformance requirements for the mobile IAB-node, if needed.*
* *Specify RRM and demodulation performance requirements for the mobile IAB-node by taking into account IAB-node mobility, if needed.*

# Topic #1: Work plan

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2319782 | Qualcomm Germany | Proposal 1: Take the content in the table 1 as agreed work plan.Table 1 mIAB demod workplan

|  |  |
| --- | --- |
| **Meeting** | **Works** |
| RAN4#109(November 2023) | * Agree the demodulation workplan
* Discuss the work scope and the list of performance test cases
 |
| RAN4#110(February 2024) | * Discuss applicability of demodulation performance requirements from legacy IAB and UE sides
* [Discuss simulation assumptions, if applicable]
 |
| RAN4#110bis(April 2024) | * Discuss the DraftCR for demodulation performance requirements
* [Collect simulation results for alignment, if applicable]
 |
| RAN4#111(May 2024) | * Discuss the remaining issues
* [Collect Simulation results with impairment, if applicable]
* Submit the BigCR and finalize the work
 |

 |

## Open issues summary

### Sub-topic 1-1 Work plan

*Sub-topic description: The Rel-18 mIAB demodulation work plan proposed by company.*

**Issue 1-1: Work plan for Rel-18 mIAB demodulation**

* Proposals
	+ Option 1: Take the content in the table 1 as agreed work plan. (QC)

**Table 1 mIAB demod workplan**

|  |  |
| --- | --- |
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* [Discuss simulation assumptions, if applicable]
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* [Collect simulation results for alignment, if applicable]
 |
| RAN4#111(May 2024) | * Discuss the remaining issues
* [Collect Simulation results with impairment, if applicable]
* Submit the BigCR and finalize the work
 |

* Recommended WF
	+ Companies to check if Option 1 could be agreed.

QC: In Rel-16/17, IAB is based on static environment, but in Rel-18, mobile IAB is different which might reuse legacy TN UE requirements, so here we propose to add such statement in workplan.

Offline tentative agreement:

|  |  |
| --- | --- |
| **Meeting** | **Works** |
| RAN4#109(November 2023) | * Agree the demodulation workplan
* Discuss the work scope and the list of performance test cases
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| RAN4#110(February 2024) | * Discuss applicability of demodulation performance requirements from legacy IAB and UE sides
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 |

# Topic #2: mIAB-MT demodulation requirements

*The demodulation requirements scope, configurations and specification related issues for mIAB-MT are discussed.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2319782 | Qualcomm Germany | Observation 1: Rel-16/17 IAB Demodulation requirements were based on static IAB nodes deployment, whereas Rel-18 mIAB nodes are dynamic, and their deployment is random within the network.Proposal 2: Rel-18 mIAB-MT performance requirements to follow applicable performance requirements from 38.101-4.Proposal 3: Rel-18 mIAB-MT performance requirements to consider tests with increased Doppler frequencies compared to Rel-16/17 IAB-MT requirements to reflect added mobility for mIAB-MT.Proposal 4: Add a new section in TS 38.174 to state that demodulation performance requirements for mIAB-MT, unless otherwise stated, follows legacy IAB-MT demodulation performance requirements.Proposal 5: Add related requirements under a suffix (i.e., Suffix A), similar to what have been done for RF and RRM mIAB-MT discussions. |
| R4-2319225 | Ericsson | Observation 1: No additional baseband processing for the enhancement on the mobility of IAB-MT.Observation 2: Legacy IAB-MT requirements for PDSCH, PDCCH and CSI reporting can not be reused because of the static or TDLA30-10 channel condition.Proposal 1: Reuse legacy NR UE demodulation requirements with TDLC300-100 channel condition, specific test cases can be further discussed. |
| R4-2319827 | Nokia, Nokia Shanghai Bell | Proposal 2. UE demodulation performance requirements can be used as the reference for mobile IAB-MT requirements as much as relevant for mobile IAB operation.Proposal 3. Additional fading channel conditions for the mobile IAB-MT performance requirements can be taken from corresponding UE cases defined in 38.101-4.Proposal 4. RAN4 to consider corresponding UE 4 RX requirements as the basis for conducted mobile IAB-MT requirements, and 2 RX for OTA. |
| R4-2320232 | Huawei, HiSilicon | Proposal 1: Define limited PDSCH and PDCCH demodulation performance requirements with mobility for Rel-18 mobile IAB-MT, e.g. 64QAM Rank1 2x4 PDSCH case with TDLB100-400 channel model and CORESET duration 1 AL4 1x4 PDCCH case with TDLC300-100 channel model. |

## Open issues summary

### Sub-topic 2-1 Requirement scope

*Moderator’s note: The following demodulation requirements are defined for IAB-MT in TS38.174.*

* *PDSCH*
	+ *FR1: rank 1/2/3/4 (channel model: TDLA30-10)*
	+ *FR2-1: rank 1/2 (channel model: TDLA30-75)*
* *PDCCH*
	+ *FR1: 1x4 and 2x4 antenna configuration (channel model: TDLA301-10)*
	+ *FR2-1: 1x2 and 2x2 antenna configuration (channel model: TDLA30-75)*
* *CSI report:*
	+ *FR1 and FR2-1: CQI (AWGN channel), PMI, RI*

**Issue 2-1-1: How to define demodulation requirements for mIAB-MT ?**

* Proposals
	+ Option 1: Define new requirements. (Huawei)
	+ Option 2: Reuse UE demodulation requirement in 38.101-4.
		- Option 2a: Reuse UE demodulation requirements with TDLC300-100 in 38.101-4. (Ericsson)
		- Option 2b: Reuse UE demodulation requirements in 38.101-4 with modified fading channel model. (QC, Nokia, Ericsson)
	+ Option 3: Other options are not precluded.
* Recommended WF
	+ Companies to discuss during the meeting.

Offline discussion:

QC: Why we need to define new requirements?

Huawei: We prefer to define new requirement from IAB perspective. We could follow principle in Rel-16/17 and just introduce requirements but no need to run simulations. We are fine to reuse legacy UE requirements but how to reuse need further discussion.

Offline tentative agreement:

Reuse applicable UE demodulation requirements in 38.101-4, and further discuss how to choose corresponding test cases.

**Issue 2-1-2: Test case scope**

* Proposals
	+ Option 1: PDSCH, PDCCH, CSI report. (Ericsson)
	+ Option 2: PDSCH, PDCCH. (Huawei)
	+ Option 3: Other options are not precluded.
* Recommended WF
	+ Companies could check if new requirements for PDSCH and PDCCH are agreeable, FFS on CSI report requirement.

Offline discussion:

Huawei: For CSI report, we do not consider high Doppler in CSI report of legacy TN UE requirement. We don’t think it is necessary to introduce new requirement, but apply IAB-MT CSI report requirement for mobile IAB-MT.

QC: Rel-16 IAB-MT CSI report is just based on AWGN which looks not so practical for mobile IAB.

Nokia and Ericsson share similar view as QC.

Huawei: Rel-16 IAB-MT use fading channel for RI/PMI report and AWGN for CQI report, and we think it is enough.

Nokia: We can consider reusing TN UE requirements for CSI report and avoid new simulations.

Offline tentative agreement:

Introduce mIAB-MT demodulation requirements for PDSCH and PDCCH.

FFS on CSI report:

Option 1: Apply IAB-MT CSI requirement.

Option 2: Reuse applicable legacy UE CSI requirements.

### Sub-topic 2-2 Test setup

**Issue 2-2-1: Frequency range**

*This issue is raised by moderator since it is mentioned by some companies implicitly in proposal.*

* Proposals
	+ Option 1: Both FR1 and FR2-1.
	+ Option 2: Only FR1.
	+ Option 3: Only FR2.
* Recommended WF
	+ Companies to check if Option 1 could be agreed.

**Issue 2-2-2: Channel model**

* Proposals
	+ Option 1: TDLC300-100. (Ericsson)
	+ Option 2: TDLB100-400 for PDSCH and TDLC300-100 for PDCCH. (Huawei)
	+ Option 3: With increased Doppler frequencies compared to Rel-16/17 IAB-MT requirements. (QC)
	+ Option 4: Other options are not precluded.
* Recommended WF
	+ Companies to discuss during the meeting.

**Issue 2-2-3: Antenna configuration for conducted test**

* Proposals
	+ Option 1: 4Rx. (Nokia)
	+ Option 2: 2x4 for PDSCH, 1x4 for PDCCH. (Huawei)
	+ Option 2: Other options are not precluded.
* Recommended WF
	+ Companies to check if 4Rx could be agreed as the start point.
	+ FFS on 1 or 2 TX.

**Issue 2-2-4: Antenna configuration for OTA test**

* Proposals
	+ Option 1: 2Rx. (Nokia)
	+ Option 2: Other options are not precluded.
* Recommended WF
	+ Companies to discuss during the meeting.

**Issue 2-2-5: Rank for PDSCH**

* Proposals
	+ Option 1: 1. (Huawei)
	+ Option 2: Other options are not precluded.
* Recommended WF
	+ Companies to discuss during the meeting.

**Issue 2-2-6: Coreset duration for PDCCH**

* Proposals
	+ Option 1: 1. (Huawei)
	+ Option 2: Other options are not precluded.
* Recommended WF
	+ Companies to discuss during the meeting.

**Issue 2-2-7: Aggregation level for PDCCH**

* Proposals
	+ Option 1: 4. (Huawei)
	+ Option 2: Other options are not precluded.
* Recommended WF
	+ Companies to discuss during the meeting.

### Sub-topic 2-3 Specification impact

**Issue 2-3-1: How to add mIAB-MT requirement to current specification?**

* Proposals
	+ Option 1: Add a new section in TS 38.174 to state that demodulation performance requirements for mIAB-MT. (QC)
	+ Option 2: Other options are not precluded.
* Recommended WF
	+ Companies to check if Option 1 could be agreed.

**Issue 2-3-2: Indicator of mIAB-MT demodulation requirements.**

* Proposals
	+ Option 1: related requirements under a suffix (i.e., Suffix A) ad RF and RRM. (QC)
	+ Option 2: Other options are not precluded.
* Recommended WF
	+ Companies to check if Option 1 could be agreed.

# Topic #3: mIAB-DU demodulation requirements

*The demodulation requirements scope, configurations and specification related issues for mIAB-DU are discussed.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2319225 | Ericsson | Observation 3: No additional baseband processing for the enhancement on the mobility of IAB-DUProposal 2: Reuse legacy IAB-DU requirements with TDLA30-10 channel condition, specific test cases can be further discussed. |
| R4-2319827 | Nokia, Nokia Shanghai Bell | Proposal 1. No new demodulation performance requirements are needed for Rel.18 mobile IAB-DU. |
| R4-2320232 | Huawei, HiSilicon | Proposal 2: Do not define any new demodulation performance requirements for Rel-18 mobile IAB-DU. |

## Open issues summary

### Sub-topic 3-1 Requirement scope

*Moderator’s note: In TS38.174, following demodulation requirements are defined for IAB-DU.*

* *PUSCH*
	+ *FR1:*
		- *Precoding disabled (1/2 Tx, 2/4/8 Rx, channel model: TDLB100-400, TDLC300-100, TDLA30-10)*
		- *Precoding enabled (1Tx, 2/4/8 Rx, channel model: TDLB100-400)*
		- *UCI multiplexing on PUSCH (1Tx, 2Rx, UCI= 7bits and 40bits, channel model: TDLC300-100).*
	+ *FR2-1:*
		- *Precoding disabled (1/2 Tx, 2 Rx, channel model: TDLA30-300 and TDLA30-75)*
		- *Precoding enabled (1Tx, 2Rx, channel model: TDLA30-300)*
		- *UCI multiplexing on PUSCH (1Tx, 2Rx, UCI= 7bits and 40bits, channel model: TDLA30-300).*
* *PUCCH:*
	+ *FR1:*
		- *Format 0/1/2/3/4 (1Tx, 2/4/8 Rx, channel model: TDLC300-100);*
		- *Multi-slot format 1(1Tx, 2Rx, channel model: TDLC300-100)*
	+ *FR2-1:*
		- *Format 0/1/2/3/4 (1Tx, 2 Rx, channel model: TDLA30-300)*
* *PRACH:*
	+ *FR1:*
		- *Normal mode for format 0, A1/A2/A3/B4/C0/C2 (1Tx, 2/4/8 Rx, channel model: TDLC300-100 with FO 400Hz)*
	+ *FR2-1:*
		- *Normal mode for A1/A2/A3/B4/C0/C2 (1Tx, 2 Rx, channel model: AWGN, TDLA30-300 with FO 4000Hz)*

**Issue 3-1: Whether to define new additional demodulation requirements for mIAB-DU?**

* Proposals
	+ Option 1: No (Ericsson, Nokia, Huawei)
	+ Option 2: Yes.
* Recommended WF
	+ Companies to check if Option 1 could be agreed.

**Issue 3-2: Which legacy IAB-DU demodulation requirements could be reused for mIAB-DU?**

* Proposals
	+ Option 1: Reuse legacy IAB-DU requirements with TDLA30-10 channel condition. (Ericsson)
	+ Option 2: Other options are not precluded.
* Recommended WF
	+ Companies to discuss based on test cases defined for IAB-DU in 38.174.